

PROJECT facts

Sequestration

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U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY



OXYGEN-FIRED CO₂ RECYCLE FOR APPLICATION TO DIRECT CO₂ CAPTURE FROM COAL-FIRED POWER PLANTS

CONTACTS

Sean Plasynski

Sequestration Technology Manager
National Energy Technology
Laboratory
626 Cochran's Mill Road
P.O. Box 10940
Pittsburgh, PA 15236
412-386-4867
sean.plasynski@netl.doe.gov

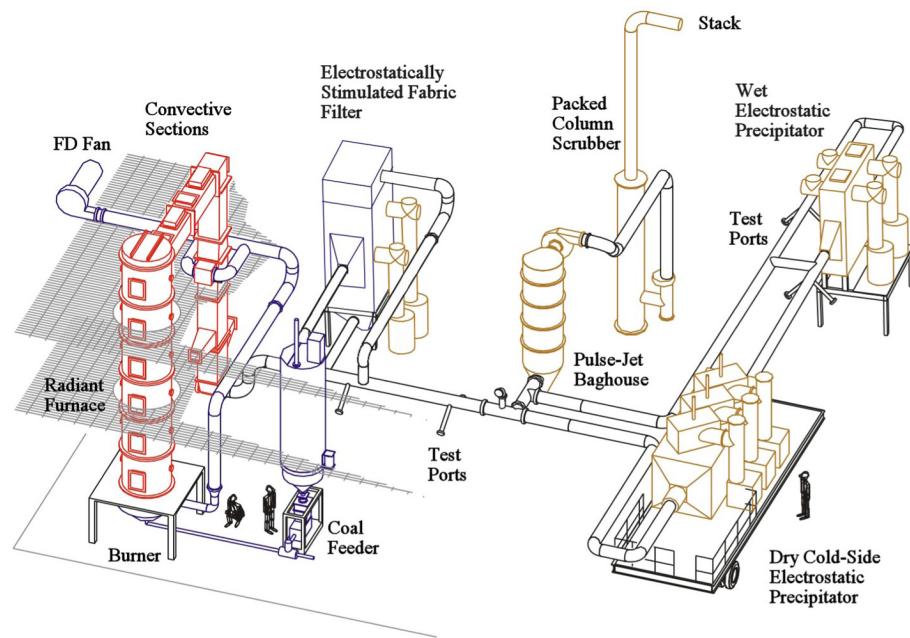
Background

Concern continues to mount over greenhouse gas emissions and their role in global climate change; and, if we are to continue burning coal, our most abundant fossil fuel, it is necessary to develop coal combustion technologies that can limit carbon dioxide (CO₂) emissions to the atmosphere. Oxyfuel combustion is an emerging technology that has the potential to allow for control of CO₂ emissions at a low cost. Oxyfuel combustion involves replacing air with pure oxygen in a pulverized coal (PC) boiler. The use of oxygen results in a lower volume of flue gas with a much higher concentration of CO₂. Combusting coal in pure oxygen results in temperatures that are too high for existing boiler and turbine materials; therefore, part of the CO₂-rich flue gas is recycled to the boiler to reduce the temperature.

Timothy Fout

Project Manager
National Energy Technology
Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507
304-285-1341
timothy.fout@netl.doe.gov

The cost of carbon capture in an oxyfuel power plant should be lower than for a conventional air-fired PC plant, as a result of the decreased flue gas volume and increased concentration of CO₂. However, these advantages are offset, to some



Schematic of the Southern Research/Southern Company Combustion Research Facility



PARTNERS

Southern Research Institute

BOC Gases

MAXON Corporation

Reaction Engineering International

CUSTOMER SERVICE

1-800-553-7681

WEBSITE

www.netl.doe.gov

COST

Total Project Value

\$1,079,654

DOE/Non-DOE Share

\$863,723 / \$215,931

extent, by the cost of providing oxygen and the cost of the recycle compressor. Through this project, Southern Research Institute will explore the feasibility of retrofitting existing PC plants with oxyfuel systems.

Primary Project Goal

The primary project goal is to thoroughly investigate, develop, optimize, and model oxyfuel combustion and CO₂ recycle to assess its feasibility for retrofit to coal-fired utility boilers.

Objectives

The major objectives of this project are to:

- Modify the pilot scale Combustion Research Facility to allow oxygen-fired and CO₂-recycle operations.
- Collect data on furnace temperatures, unburned carbon, gas composition, and flow rates into and out of the furnace.
- Evaluate the effect of various parameters, including firing configuration, oxygen purity, CO₂ recycle rate, oxygen concentration, and coal type.
- Design, manufacture, and install an oxyfuel burner specifically for the Combustion Research Facility.

Accomplishments

- The design of facility modifications and additions is underway.
- Initial testing of the new facility configuration will begin in September, 2006.

Benefits

A number of studies have shown that recovering CO₂ from the flue gas at a PC-fired boiler will significantly increase the cost of electricity (COE). The main reasons are that the volume of gas is very large and the concentration of CO₂ is low, typically less than 15%. Commercially available absorption processes, such as amine based systems, require large vessels and consume considerable parasitic power. Development of oxyfuel technology will simplify carbon capture in PC-fired power plants by minimizing the volume of flue gas produced and vastly increasing the CO₂ concentration, thereby significantly reducing CO₂ capture cost. Successfully retrofitting oxyfuel technology into existing PC power plants will enable CO₂ capture goals to be met at a lower capital investment than would be required to construct all new facilities.